University of Saskat
College of Engineering
EE 341.3: Electrical Machines I
Midterm Examination

February 13, 2003

Instructor: Dr. N. Kar
Time: 1 hour & 20 min.
Note: Two sheets of handwritten formulas permitted

Marks

20 1. (a) The parameters of the equivalent circuit of the 150-kVA, 2,400-V/240-V transformer shown in Fig. 1 are R_1 =0.2 Ω, R_2 =0.002 Ω, X_1 =0.45 Ω, X_2 =0.0045 Ω, R_c=10 kΩ and X_m =1.55 kΩ. This equivalent circuit is referred to the primary. Determine the

(a) voltage regulation.

(b) efficiency of the transformer operating at rated load with rated voltage of 240 V and 0.8 lagging power factor.

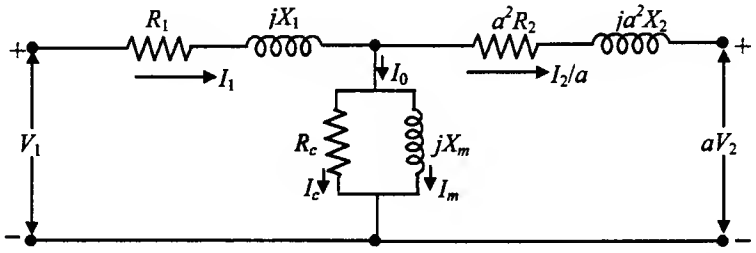

Fig. 1. Transformer equivalent circuit referred to the primary.

10 (b) A 3-kVA, 220-V/110-V, 60-Hz, single-phase transformer yields this test data:

open-circuit test: 200 V, 1.4 A, 50 W
short-circuit test: 4.5 V, 13.64 A, 30 W

Determine the efficiency when the transformer delivers a load of 2 kVA at 0.85 power factor lagging.

20 2. A three-phase, 220-V, 60-Hz, 4-pole, Y-connected induction motor has a per-phase stator resistance of 0.5 Ω. The following no-load and blocked-rotor test data on the motor are given:

No-load test: Line-to-line voltage = 220 V
Total input power = 600 W, of which 200 W is the friction and windage loss
Line current = 3 A

Blocked-rotor test: Line-to-line voltage = 35 V
Total input power = 720 W
Line current = 15 A

(a) Calculate the parameters of the equivalent circuit shown in Fig. 2.

(b) Find the output power, output torque, and efficiency if the machine runs as a motor with a slip of 0.05.

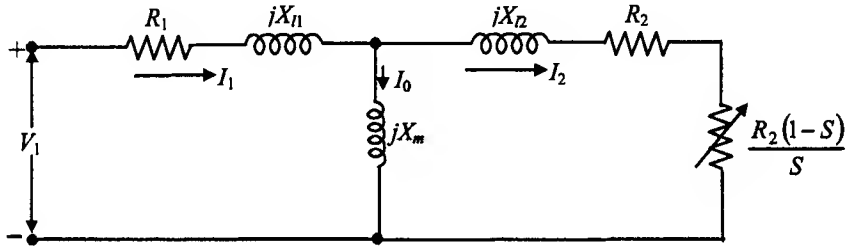

Fig. 2. Induction motor equivalent circuit referred to the stator.

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